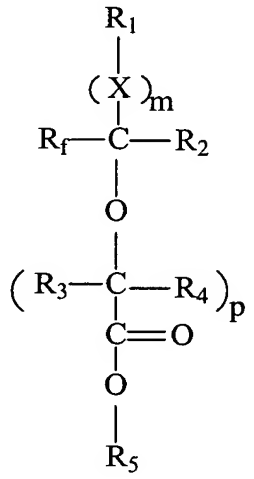
Claims

1. A photoresist composition comprising a photoacid generator and at least one novel polymer comprising at least one unit as described by structure 1,



(1)

where, either

(i) R_1 is an aliphatic cyclic unit of a polymer, R_2 is selected from H, F, (C_1-C_8)alkyl, (C_1-C_8)fluoroalkyl, cycloalkyl, cyclofluoroalkyl, and $(CR_3R_4)p(CO)OR_5$, and R_f is selected from F, H, (C_1-C_8)alkyl, or a fully or partially fluorinated alkyl, and cyclofluoroalkyl, or

(ii) R_1 and R_2 combine to form an aliphatic cyclic unit of a polymer, and R_f is selected from F, H, (C_1-C_8)alkyl and a fully or partially fluorinated alkyl, and cyclofluoroalkyl, or

(ii) R_1 and R_f combine to form an aliphatic cyclic unit of a polymer, and R_2 is selected from H, F, (C_1-C_8)alkyl, (C_1-C_8)fluoroalkyl, cycloalkyl, cyclofluoroalkyl, and $(CR_3R_4)p(CO)OR_5$; and,

R_3 and R_4 are independently H, F, (C_1-C_8)alkyl, (C_1-C_8)fluoroalkyl, cycloalkyl, cyclofluoroalkyl, $(CR_3R_4)p(CO)OR_5$, R_3 and R_4 may combine to form an alkylspirocyclic or a fluoroalkylspirocyclic group,

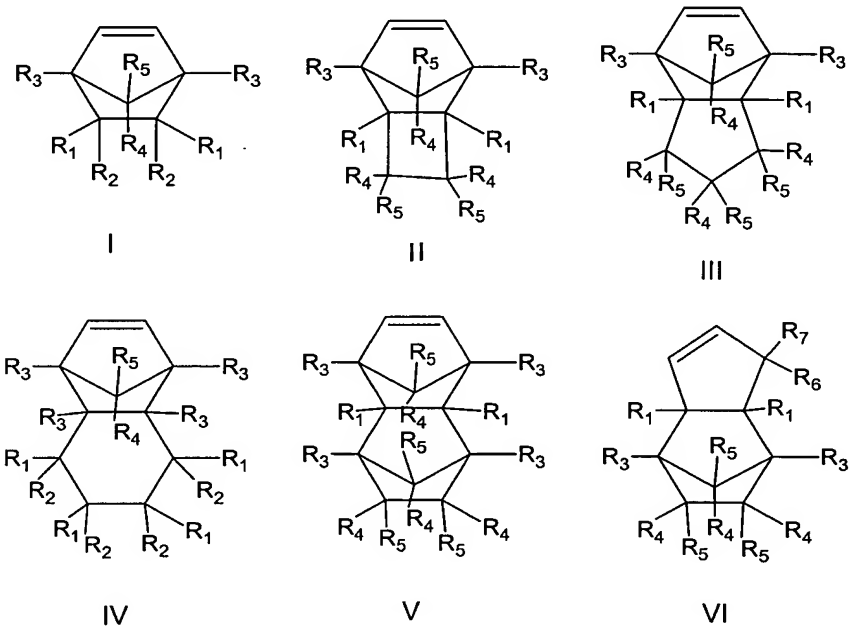
X is selected from (C_1-C_8)alkylene, (C_1-C_8)fluoroalkylene, O(C_1-C_8)alkylene, O(C_1-C_8)fluoroalkylene, cycloalkyl and fluorinatedcycloalkyl,

R_5 is H or an acid labile group, m=0-1, and p=1-4.

2. The composition according to claim 1, where the polymer comprising the unit of structure 1 is a reaction product of polymer containing an aliphatic cyclic fluoroalcohol unit with a compound capable of functionalizing the fluoroalcohol unit with an alkyloxycarbonylalkyl group.

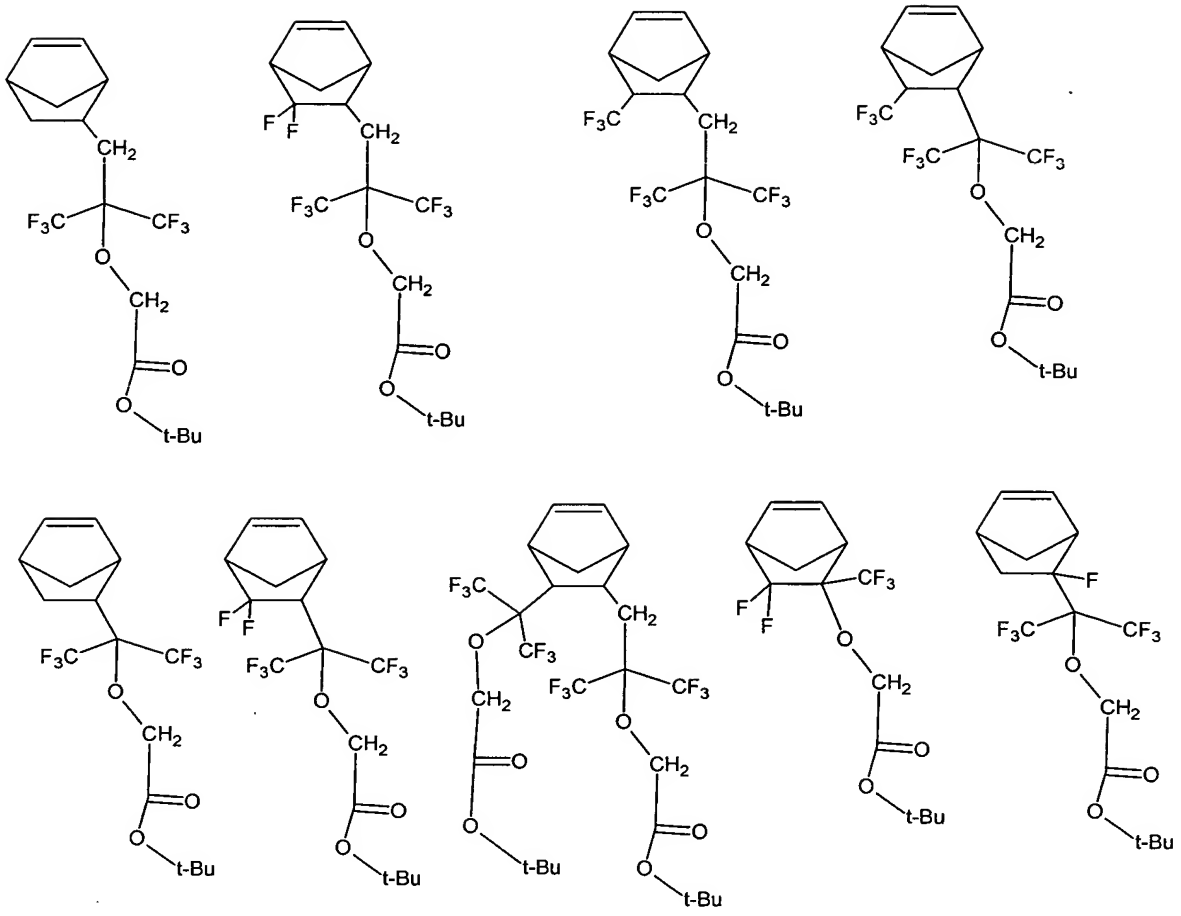
3. The composition according to claim 1, where the cyclic unit is an aliphatic multicyclic unit or an aliphatic monocyclic unit.

4. The composition according to claim 1, where the unit of structure 1 is selected from those derived from the following monomers,



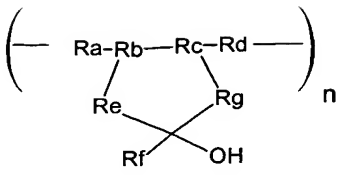
where, in the above structures, R_1-R_7 are independently H, F, (C1-C8)alkyl, (C1-C8)fluoroalkyl, and at least one of R_1-R_6 forms the unit described in structure 1.

5. The composition according to claim 1, where the unit of structure 1 is selected from the group derived from the following monomers,

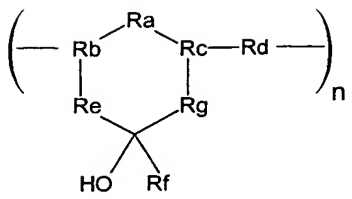


6. The composition according to claim 1, where the aliphatic cyclic unit is a monocyclic unit.

7. The composition according to claim 1, where the polymer comprising the unit of structure 1 is a reaction product of polymer containing an aliphatic monocyclic fluoroalcohol unit with a compound capable of functionalizing the fluoroalcohol unit with an alkyloxycarbonylalkyl group, and further where the monocyclic fluoroalcohol polymer is selected from,



I



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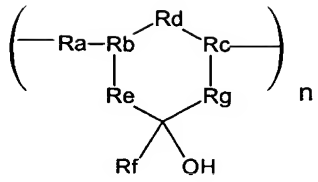

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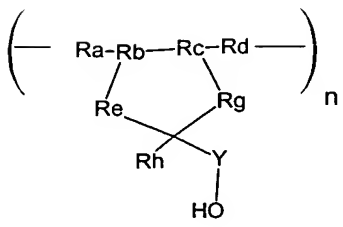

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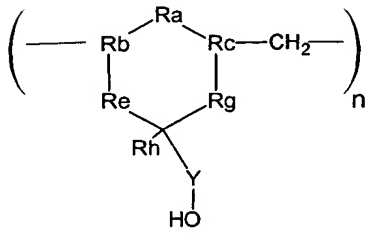

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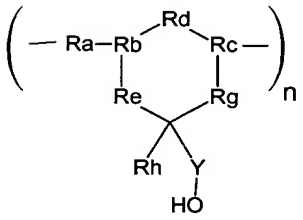

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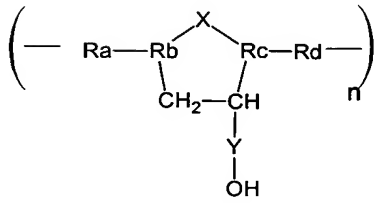
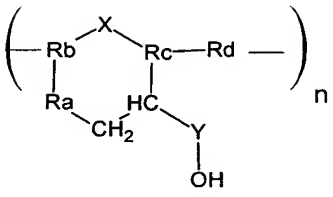
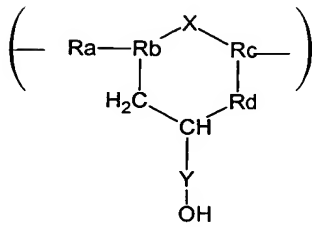


VII



VIII



VIII

Rf is a fluoroalkyl group (C_1-C_8)

Ra, Rb, Rc, Rd, Re, Rg, Rh are independently alkyl, fluoroalkyl, fluorocycloalkyl, and Ra-Re and Rg can independently be substituted with alkyl, fluoroalkyl, cycloakyl, fluorocycloalkyl or with a spirofluoroalkyl or spiroalkyl subsituent

Y is independently alkyl or fluoroalkyl spacer group (C1-C8)

X is independently CF_2 and O

8. The composition of claim 2, where the alkyloxycarbonylalkyl group is selected from t-butyloxycarbonylmethyl, methyl-adamantyloxycarbonylmethyl, t-amyloxycarbonylmethyl, methyl-norbornyloxycarbonylmethyl, t-butyloxycarbonylpropyl and t-butyloxycarbonyldifluorobutyl.

9. The composition of claim 1, where the acid labile group is selected from secondary and tertiary alkyls, acetals and ketals, trimethylsilyl, β-trimethylsilyl substituted alkyls, tetrahydrofuranyl, tetrahydropyranyl, substituted or unsubstituted methoxymethoxycarbonyl, and β-trialkylsilylalkyl.

10. The composition of claim 1, where the polymer comprises further units containing nonacid labile groups and/or acid labile groups.

11. The composition of claim 1, where the polymer is selected from poly(bicyclo[2.2.1]hept-5-en-2-yl)-1,1,1-trifluoro-2-(trifluoromethyl)propan-2-ol), poly(1,1,2,3,3-pentafluoro-4-trifluoromethyl-4-hydroxy-1,6-heptadiene and poly(1,1,2,3,3-pentafluoro-4-trifluoroalkyl-4-hydroxy-1,6-heptadiene).

12. The composition of claim 1, where the polymer comprises a mixture of polymers comprising monocyclic units and polymers comprising multicyclic units.

13. The composition of claim 12, where the polymer mixture is poly(bicyclo[2.2.1]hept-5-en-2-yl)-1,1,1-trifluoro-2-(trifluoromethyl)propan-2-ol) with poly(1,1,2,3,3-pentafluoro-4-trifluoromethyl-4-hydroxy-1,6-heptadiene).

14. The composition of claim 1, where the composition further comprises a dissolution inhibitor.

15. The composition of claim 1, where the composition further comprises a base or a photobase.

16. The composition of claim 1, further comprising secondary polymers.

17. The composition of claim 1, where the photoacid generator is selected from diazonium salts, iodonium salts, sulfonium salts, triazines, oxazoles, oxadiazoles, thiazoles, substituted 2-pyrones, phenolic sulfonic esters and mixtures thereof.

18. A process for imaging a photoresist composition comprising the steps of:

a) forming on a substrate a photoresist coating from the photoresist composition of claim 1;
b) image-wise exposing the photoresist coating;
c) postexposure baking the photoresist coating; and
d) developing the photoresist coating with an aqueous alkaline solution.

19. The process according to claim 18, where the image-wise exposure wavelength is below 200 nm.

20. The process according to claim 18, where the aqueous alkaline solution comprises tetramethylammonium hydroxide.

21. The process according to claim 18, where the aqueous alkaline solution further comprises a surfactant.

22. A process for making the polymer of claim 1, where a polymer comprising an aliphatic cyclic fluoroalcohol unit is reacted with a compound capable of functionalizing the fluoroalcohol unit with an alkyloxycarbonylalkyl group, in the presence of a mixture comprising at least one organic base.

23. The process of claim 22, where the organic base is selected from an ammonium base, a phosphonium base and a sulfonium base.

24. The process of claim 22, where the organic base is $(R_1')(R_2')(R_3')(R_4')NOH$, and wherein R_1',R_2',R_3' and R_4' are independently $(C_1\text{-}C_{20})$ alkyl.

25. The process of claim 22, where the mixture further comprises a salt selected from an ammonium salt, phosphonioum salt and sulfonium salt.

26. The process of claim 22, where the organic base is selected from tetramethyl ammonium hydroxide, tetrabutyl ammonium hydroxide and mixtures thereof.

26. The process of claim 22, where the cyclic unit is an aliphatic multicyclic unit or an aliphatic monocyclic unit.

27. The process of claim 22, where the alkyloxycarbonylalkyl group is selected from t-butyloxycarbonylmethyl, methyl-adamantyloxycarbonylmethyl, t-amyloxycarbonylmethyl, methyl-Inorbornyloxycarbonylmethyl, t-butyloxycarbonylpropyl and t-butyloxycarbonyldifluorobutyl.